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IS 12710 (1989): Glossary of terms used in acoustic emission testing [MTD 21: Non-Destructive Testing]



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“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

**ACOUSTIC EMISSION TESTING —
GLOSSARY OF TERMS**

**भारतीय मानक
ध्वानिक उत्सर्जन परीक्षण — शब्दावली**

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NEW DELHI 110002

Non-destructive Testing Sectional Committee, SMDC 25

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on 5 April 1989, after the draft finalized by the Non-destructive Testing Sectional Committee had been approved by the Structural and Metals Division Council.

Non-destructive testing by acoustic emission is being used in the country for a variety of inspection jobs and it was felt necessary to define the various terms used in the field. The terms commonly used in the applications of acoustic emission techniques are covered in this standard.

This standard is based on ASTM E 610-82 'Standard definitions of terms relating to acoustic emission', issued by the American Society for Testing and Materials, USA and Code IV of the code subgroup of European Working Group on Acoustic Emission.

Indian Standard

ACOUSTIC EMISSION TESTING — GLOSSARY OF TERMS

1 SCOPE

1.1 This standard defines the terms commonly used in acoustic emission testing (AET).

2 TERMINOLOGY

2.1 Acoustic Emission (AE)

The class of phenomena whereby transient elastic waves are generated by the rapid release of energy from localized source within a material, or the transient elastic waves so generated. Acoustic emission (AE) is the recommended term for general use. Other terms that have been used in AE literature include:

- a) Stress wave emission (SWE)
- b) Micro-seismic activity, and
- c) Emission or acoustic emission with other qualifying modifiers.

2.2 Acoustic Emission Channel

An assembly of a sensor, preamplifier or impedance matching transformer, filters, secondary amplifier or other instrumentation as needed, connecting cables, and detector or processor.

2.3 Acoustic Emission Count (N)

The number of times the acoustic emission signal exceeds a preset threshold during any selected portion of a test.

2.4 Acoustic Emission Count Rate (N°)

The time rate at which emission counts occur.

2.5 Acoustic Emission Event

A local material change giving rise to acoustic emission.

2.6 Acoustic Emission Event Energy

The total elastic energy released by an emission event.

2.7 Acoustic Emission Sensor (Transducer)

A detection device, generally piezoelectric, that transforms the particle motion produced by an elastic wave into an electrical signal.

- a) *Transducer (Resonant)* — Transducer which uses the mechanical amplification due to a resonant frequency (or several close resonant frequencies) to give a high sensitivity in a narrow band, typically ± 10 percent

of the principal resonant frequency at the -3 dB points.

- b) *Transducer (Flat Response)* — Transducer whose frequency response has no resonance within its specified frequency band, the bandwidth to -3 dB being defined and the ratio between the upper and lower limits of the band being typically not less than 10.
- c) *Transducer (Wide Band)* — Transducer which uses the mechanical amplification due to the superposition of multiple resonances to give high sensitivity in several narrow bands within a specified wide band.
- d) *Transducer (Single Ended)* — A piezoelectric single element transducer, the output pole of which is isolated from the case and the other pole being at the same potential as the case.
- e) *Transducer (Differential)* — A piezoelectric twin-element or dual-pole transducer, the output poles of which are isolated from the case and are at a floating potential.

2.8 Acoustic Emission Signal

An electrical signal obtained by detection of one or more acoustic emission events.

2.9 Acoustic Emission Signal Amplitude

The peak voltage of the largest excursion attained by the signal waveform from an emission event.

2.10 Acoustic Emission Signature

A characteristic set of reproducible attributes of acoustic emission signals associated with a specific test article as observed with a particular instrumentation system under specified test conditions.

2.11 Acoustic Emission Waveguide

A device that couples elastic energy from a structure or other test object to a remotely mounted sensor during AE monitoring. An example of an acoustic emission waveguide would be a solid wire or rod, that is, coupled at one end to a monitored structure and to a sensor at the other end.

2.12 Arrival Time Interval (ΔT_{ij})

The time interval between the detected arrivals of an acoustic emission wave at the i th and j th sensors of a sensor array.

2.13 Artificial Source

Point where elastic waves, simulating an event, are created. This term also defines the device used to create the waves.

2.14 Background Noise

The signal in the absence of any acoustic emission events. It has electrical and mechanical origins.

2.15 Burst Duration

Time interval between the first and last time the threshold was exceeded by the burst.

2.16 Burst Emission

A qualitative description of discrete signal related to an individual emission event occurring within the material.

NOTE — Use of the term 'burst emission' is recommended only for describing the qualitative appearance of emission signals. Figure 2 shows an oscilloscope trace of burst emission signals.

2.17 Continuous Emission

A qualitative description of the sustained signal level produced by rapidly occurring acoustic emission events.

NOTE — Use of the term 'continuous emission' is recommended only for describing the qualitative appearance of emission signals. Figure 3 shows oscilloscope traces of continuous emission signal at sweep rate of 5 ms/cm.

2.18 Couplant

A material used at the structure-to-sensor interface to improve the transmission of acoustic energy across the interface during acoustic emission monitoring.

2.19 Cumulative Acoustic Emission Amplitude Distribution, $E(V)$

The number of acoustic emission events with signals that exceed an arbitrary amplitude as a function of amplitude V .

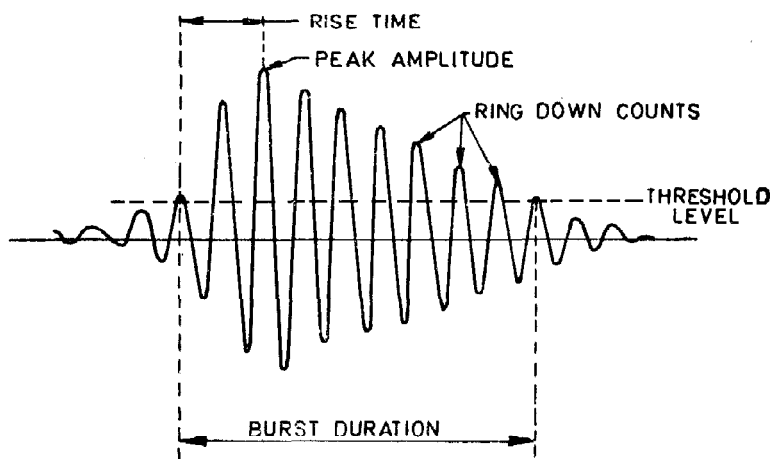


FIG. 1 PARAMETERS OF CHARACTERIZING A BURST

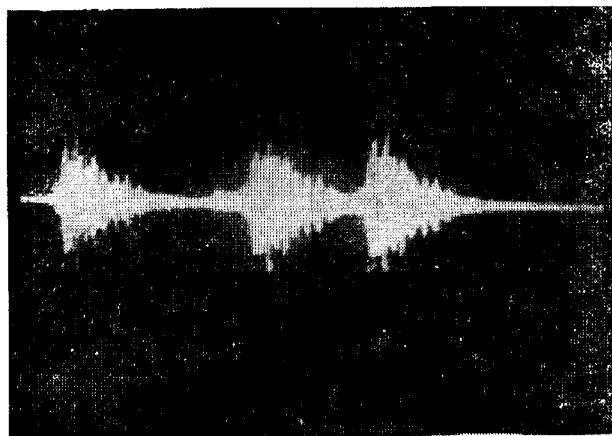


FIG. 2 AN OSCILLOSCOPE TRACE OF BURST EMISSION SIGNALS (SWEEP RATE OF 0.2 ms/cm)

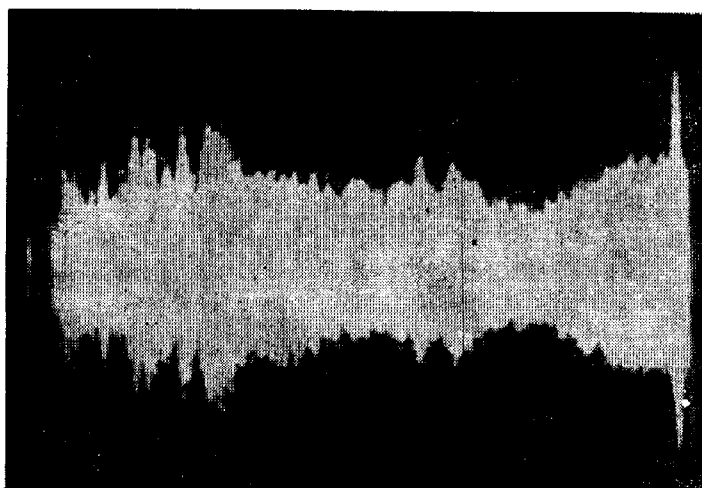


FIG. 3 OSCILLOSCOPE TRACES OF CONTINUOUS EMISSION SIGNALS (SWEEP RATE OF 5 ms/cm)

2.20 Cumulative Acoustic Emission Threshold Crossing Distribution, $E_t(V)$

The number of times the acoustic emission signal exceeds an arbitrary threshold as a function of the threshold voltage (V).

2.21 Delta (t), see 2.12

2.22 Differential Acoustic Emission Amplitude Distribution, $f(V)$

The number of acoustic emission events with signal amplitudes between amplitudes V and $V + \Delta V$ ($V + \text{delta } V$) as a function of the amplitude V . $f(V)$ is the absolute value of the derivative of the cumulative amplitude distribution $F(V)$.

2.23 Event Count (N_e)

The number obtained by counting each discerned acoustic emission event once.

2.24 Event Count Rate (N_e)

The time rate of the event count.

2.25 Felicity Effect

The appearance of significant acoustic emission at a stress level below the previous maximum applied level, such as observed in composite materials.

2.26 Felicity Ratio

Measurement of the felicity effect is defined as the ratio between the applied load (pressure) at which the acoustic emission reappears during the next application of loading (pressure) and the previous maximum applied load (pressure).

2.27 Kaiser Effect

The absence of detectable acoustic emission at a fixed sensitivity level until previously applied stress levels are exceeded.

2.28 Logarithmic Acoustic Emission Amplitude Distribution, $g(V)$

The number of acoustic emission events with signal amplitudes between V and αV (where α is a constant multiplier) as a function of the amplitude. This is a variant of the differential amplitude distribution, appropriate for logarithmically windowed data.

2.29 Parameter (AE) Distribution

A display of the number of times the acoustic emission parameter falls between the values x and $x + \delta x$ as a function of x . Typical parameters are amplitude, rise time and duration.

2.30 Pulser Transducer

Transducer used as artificial source.

2.31 Reference Threshold

Present voltage level which has to be exceeded, before an AE signal is detected and processed (Fig. 1). This threshold may be adjustable, fixed or floating.

2.32 Ring Down Count

See 2.3 acoustic emission count the preferred term.

2.33 Stimulation

The application of a stimulus, such as force, pressure, heat, etc. to a test article to excite acoustic emission sources.

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